

SECTION 02370

DRILLED SHAFTS

PART 1 - GENERAL

0.1 DESCRIPTION OF WORK

- A.** Work Included: This Section specifies requirements for foundations constructed by drilling or excavating a shaft and filling it with reinforced concrete as indicated. Work also includes the disposal of existing obstructions encountered within the limits of the drilled shaft foundation.
- B.** Related Work: The following items are not included in this Section and will be performed under the designated Sections:
 - 1. Section 03300 - CAST-IN-PLACE CONCRETE; for Portland cement concrete, concrete reinforcement, and incidentals pertaining thereto, except as modified herein.

0.2 SUBMITTALS

- A.** Shop Drawings: Show detailed description of procedures and equipment intended to be employed including proposed equipment, methods, sequence of operations, details of excavation and dewatering; calculations showing the adequacy of casings to support soil pressures; personnel protection; fabrication, construction, transportation, and erection of reinforcement; and concrete placement.
- B.** Submit welding procedures and qualifications of welders as specified in AWS D1.1 for casing steel and AWS D1.4 for reinforcing steel.
- C.** Submit concrete mix designs.
- D.** Submit methods of placing concrete.
- E.** Submit method of monitoring verticality of the shaft excavation.
- F.** Submit methods and materials to complete corrections of out-of-tolerance drilled shafts.
- G.** Submit for approval prior to performing the work the form used to document drilled shaft installations.
- H.** Submit records for each drilled shaft installed including alignment, dimensions, elevation of water table and elevations of top and bottom.

- I. Qualifications and inspection reports of Test and Inspection Agency.

0.3 INSPECTION AND TESTING

- A. Concrete test cylinders for acceptance testing shall be made as specified in Section-03300 CAST-IN-PLACE CONCRETE.
- B. Welding Inspection - as a minimum all welds shall be visually inspected.
- C. Hold Point - After completion of excavation and prior to placement of reinforcing steel and concrete, the condition of the excavation will be inspected by the Engineer. Remove any sloughage or other loose material from the shaft prior to placing reinforcing steel and concrete. An accumulation of muck in the bottom of the excavation will not be allowed.

PART 2 - PRODUCTS

0.1 CONCRETE

- A. Concrete: Section 03300 - CAST-IN-PLACE CONCRETE, of the class indicated on the Contract Drawings, with the following additional requirements:
 - 1. Slump: 6 to 9 inches.
 - 2. Air Content: 2 1/2 to 5 1/2 percent.
 - 3. 705 lb. Cement.

0.2 STEEL

- A. Reinforcing Steel: ASTM A 615 and as shown on the Drawings.
- B. Casing Steel: Welded, ASTM A36; thickness as indicated, but not less than 1/4 inch.

0.3 SLURRY

- A. Stable suspension of bentonite clay or polymer in water. Density as required to provide for adequate excavation support.

PART 3 - EXECUTION

0.1 FIELD QUALITY CONTROL

- A.** Drilled Shaft Logs: Keep a record, on an accepted form, for each drilled shaft installed. Record on the form the location, dimensions, elevations of top and bottom, depth of stratum penetration, elevation of water table during excavation, condition of bottom of excavation, quantity of water entering excavation during concreting, concreting data and any other data called for on the accepted report from or pertinent to the drilled shaft.
- B.** Perform welding inspection as required.
- C.** Cast cylinders at the frequency stated in Section 03300-CAST-IN-PLACE CONCRETE.

0.2 TOLERANCES

- A.** Maximum variation of the center of any drilled shaft from the required location: three inches, measured at the ground surface.
- B.** Bottom Diameter: minus zero, plus six inches measured in any direction.
- C.** Maximum Variation From Plumb: 1:40.

0.3 SEQUENCING AND SCHEDULING

- A.** Schedule excavating, coring, installation of reinforcing steel, and concreting so that each excavated shaft is poured immediately after drilling or other excavating is complete and reinforcing steel placed and accepted.
- B.** Do not allow vibration or excessive wheel loads within the immediate vicinity of any pier. Maintain excavation stable at all times.

0.4 ON-SITE REINFORCING STEEL FABRICATION

- A.** Where it is not practicable to deliver the cage assembly to the jobsite as a complete unit ready for installation, make the remaining connections or splices, as indicated on the Contract Drawings, at-grade prior to lowering the assembly into the hole. Use clips and ties only for connections which must be made in the excavated hole, as accepted by the Engineer.

0.5 EXCAVATION AND PLACEMENT

- A.** Excavate drilled shafts to the dimensions and elevations shown on the contract drawings

- B.** Maintain sidewall stability with steel cylinder casing, drilling slurry or accepted sheeting to prevent instability or displacement of the surrounding earth during drilling
- C.** If an obstruction is encountered, notify the Engineer immediately
- D.** Conduct hole bottom tests to confirm the bottom of the excavation is reached
- E.** If groundwater modifications endangers the stability of the excavation or adjacent property, the Contractor shall incorporate corrective measures
- F.** Prior to rebar installation, inspect and clean all reinforcing of mud, oil and other deleterious materials
- G.** Make splices in reinforcement as shown on the drawings.
- H.** Lower the reinforcing steel into the hole while preventing damage to sidewalls
- I.** Place concrete in dry excavations by free fall concrete, directing the flow down the center of the shaft without contacting the sidewalls or the reinforcing steel. Place concrete in one continuous operation.
- J.** Place concrete in wet excavations by tremie pipe. Use 8 inch inside diameter tremie pipe with watertight joints. Do not use any aluminum components.
- K.** Keep the pipe embedded in the concrete at least 5 feet
- L.** Withdraw temporary steel casing as the concrete is being placed or unless the casing is to be left in place. Withdraw so that the lower edge of the casing is a minimum of 3 feet below the surface of concrete being placed.
- M.** Vibrate the top 5 feet of concrete.
- N.** Fill void spaces between permanent casing and shaft excavation with concrete or fluid grout.

PART 4 - MEASUREMENT AND PAYMENT

0.1 MEASUREMENT

- A.** Drilled shafts will be measured by the vertical foot complete in place.
- B.** Excavation, groundwater control, exploratory drilling and coring, and support of excavation for pier foundations, will not be separately measured for payment; but all costs in connection therewith will be considered incidental to the construction of pier foundations.

0.2 PAYMENT

- A.** Payment for drilled shafts will be made at the Contract unit prices for the quantities determined as specified above.

0.3 PAYMENT ITEMS

ITEM NO.	DESCRIPTION	UNIT
0235.271	DRILLED SHAFTS	VF

END OF SECTION

NOTES TO THE DESIGNER

- A.** Any request to modify or waive the specification requirements listed below must be approved in writing by the MBTA's Director of Design:

1. None